PATENT APPLICATION
Application No. 10/709,831
Paper Dated: January 19, 2006
Attorney Docket No. TSENTER.00101

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the present application.

1. (currently amended) A method of charging a Li-based ~~batteries~~ battery by constant current and then by constant voltage to minimum current, ~~with following operations~~ comprising:

a. ~~Measurement of~~ Measuring battery ohmic resistance of a Li-based battery;

b. Setting ~~of~~ a minimum overvoltage protection value; and

c. Setting ~~of~~ a minimum charging current depending on the battery ohmic resistance and the overvoltage protection value.

2. (currently amended) The method of ~~charging Li-based battery of~~ claim 1, wherein said overvoltage protection value ~~is specified as~~ comprises a difference between maximum voltage and instantaneous open-circuit voltage at ~~battery~~ terminals of the battery after 1 to 10 ms of current ~~change~~ interruption.

3. (currently amended) The method of ~~charging Li-based battery of~~ claim 1, wherein said minimum charging current is chosen as a ratio of the minimum overvoltage protection value to the battery ohmic resistance.

4. (currently amended) The method of ~~charging Li-based battery of~~ claims 1-3, wherein the maximum voltage, V_{max}, ranges between 4.0 and 4.2 V per cell.

5. (currently amended) The method of ~~charging Li-based battery of~~ claim 1, wherein the constant voltage is instantaneous open-circuit voltage.

6. (currently amended) The method of ~~charging Li-based battery of~~ claim 1, wherein the constant voltage equals maximum voltage.

7. (currently amended) The method of ~~charging Li based battery of~~ claim 1, wherein the constant voltage equals maximum voltage plus a product of the minimum charging current and the ohmic resistance.

8. (currently amended) The method of ~~charging Li based battery of~~ claim 1, wherein the minimum overvoltage protection is 0 to 50 mV.

9. (currently amended) The method of ~~charging Li based battery of~~ claim 1, wherein a tolerance of supporting constant voltage has to be less than the minimum ~~ovevoltage~~ overvoltage protection.

10. (currently amended) The method of ~~charging Li based batteries of~~ claims 1, wherein the minimum charging current reaches 0.6-0.05C rate.

11. (currently amended) A method of Li-based battery equalization in a process of battery charging and discharging, ~~wherein~~ comprising periodically connecting an individual lithium cell ~~is periodically connected~~ to a battery lithium cell ~~having minimum discharging voltage~~ until voltage of the two cells is getting equal to a dynamically preselected voltage.

12. (cancelled)

13. (currently amended) A method of Li-based battery equalization, wherein three series-connected Ni-based batteries are connected in parallel to ~~each~~ an Li-based cell, and the Ni-based cells are part of a charging device.

14. (currently amended) A method of hybridizing lithium battery and creating one hybrid power source, wherein ~~each~~ a lithium cell permanently contains three series- connected Ni-based cells, wherein the Li-based cell and the Ni-based cells have parallel connection.

15. (currently amended) The method of ~~charging Li based battery of~~ claims ~~11~~ 13 and ~~12~~ 14 further comprising charging by constant current, and constant voltage, wherein charging is interrupted when charging current reaches stationery value.

16. (cancelled)

17. (currently amended) ~~Battery control~~ The method of claim 1~~1~~4, wherein ohmic resistance is measured as a ratio of two voltage differences corresponding to two current differences measured within a 1- to 10-~~ms.~~ millisecond time interval after current interruption.

18. (currently amended) ~~Battery control~~ The method of claim 17~~15~~, wherein one of two currents is zero.

19. (currently amended) ~~Battery control~~ The method of claim 1~~1~~4, further comprising measuring ~~wherein~~ chemical resistance ~~is measured~~ of the battery~~as ratio of two voltage differences sampled prior to 10 ms and after 150 ms current change corresponding to two current differences~~.

20. (cancelled)

21. (currently amended) The ~~battery control~~ method of claim 19~~1~~4, ~~wherein~~ further comprising determining nonstationary open-circuit voltage is defined as:

$E_0 = V - I(R_{ohm} + R_{ch})$, where:

V= ~~difference between~~ battery terminal voltage;

~~and product of sum of~~ R_{ohm} = ohmic resistance; ~~and~~

R_{ch} = chemical resistances~~,~~; and

I = current.

22. (currently amended) The ~~battery control~~ method of claims 21 ~~14 and 19~~, wherein nonstationary open-circuit voltage is used to recognize battery state-of-charge.

23. (currently amended) A method of measuring battery ~~The battery control method of claim 14, wherein electrical~~ double layer capacity ~~is measured by~~ comprising

sampling chemical polarization for 10 to 15 ms after current interruption, and obtaining a ratio of product of current and time interval to chemical polarization difference for this time interval.

24. (currently amended) The method of ~~charging and controlling Li-based battery of~~ claims 1, 11, and 14 wherein said battery is an Li-ion battery.

25. (currently amended) The method of ~~charging and controlling Li-based battery of~~ claims 1, 11, and 14 wherein said battery is an Li polymer battery.

26. (currently amended) The method of ~~charging and controlling Li-based battery of~~ claims 1, 11, and 14 wherein said battery is a metallic Li battery.

27. (new) The method of claim 1, wherein ohmic resistance is measured as the ratio of a voltage difference to a current difference over a time period between 1 millisecond and 10 milliseconds after current interruption.

28. (new) The method of claim 21, wherein R_{ch} is measured as a ratio wherein the numerator comprises a difference between a first voltage sampled prior to 10 milliseconds and a second voltage sampled after 150 milliseconds after current interruption, and the denominator comprises a current charge value.